The CRUSHED STONE JOURNAL

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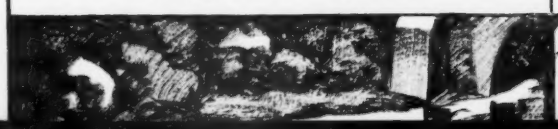

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Stone Sand

Single copies of the above bulletins are available upon request.

The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

NATIONAL CRUSHED STONE ASSOCIATION

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THE
CRUSHED STONE JOURNAL
WASHINGTON, D. C.

Vol. XI No. 8 DECEMBER, 1936

Industry Attention Focuses on Cincinnati Excellent Attendance Anticipated For Annual Convention

WITH the festivities of the Holiday Season now behind us, interest among crushed stone producers centers on Cincinnati where the Twentieth Annual Convention of the National Crushed Stone Association will be held at the Netherland Plaza Hotel, January 18, 19 and 20. Program arrangements are virtually completed and advance hotel reservations received to date by the Netherland Plaza foreshadow an excellent attendance. We know of no more auspicious way to begin the year's activities than to foregather and exchange ideas with those engaged in the same line of endeavor, coupled with the opportunity which the convention affords of hearing topics of outstanding interest discussed by men of national reputation. We believe that the Cincinnati meeting, to an unusual degree, offers a well balanced mental diet, certain to prove helpful and inspiring in our common endeavor to further the interests of the crushed stone industry and its individual members during the coming year.

Because in previous accounts of the activities scheduled during the convention period we have failed to outline in any detail our plans with regard to the lighter moments of the convention, it should by no means be construed that we are unaware of the desirability of relieving the serious phase of the convention program with appropriate entertainment. Our plans in this regard are now complete and may be briefly summarized as follows:

On Monday afternoon at 6:30 the Manufacturers' Division will hold a reception for all in attendance at the convention, followed immediately by a buffet supper. At eight o'clock the Manufacturers' Division Exposition will be formally opened.

On Tuesday evening at eight o'clock there will be held the Convention Cabaret. An excellent program of entertainment will be provided in the form of a floor show featuring a number of unique acts. Intermission will be declared at appropriate times during the floor show for the purpose of general dancing and at its conclusion dancing will be continued until midnight. The Convention Cabaret is certain to prove a popular feature of the week with a good time assured to all who are present.

The Annual Banquet of the Association will be held on Wednesday evening. During the serving of the dinner entertainment appropriate to the occasion will be provided, following which the speaker of the evening will be presented. The Banquet is scheduled to close about 10:30; consequently, there will be but one feature address. This plan is being followed in order to permit those who may so desire to take late trains from Cincinnati. From 5:30 to 7:00 immediately preceding the Banquet a reception will be held by the President of the Association for all members and guests at the convention.

It is hoped that the ladies will be present at Cincinnati in large numbers and a special program for their entertainment has been arranged carefully, featuring a visit to the Taft Museum and the Rookwood Pottery, a theatre party and a bridge party. Headquarters, which will be most attractive and comfortable, will be established for the ladies and

(Continued on page 14)

PROGRAM—TWENTIETH ANNUAL CONVENTION

Monday, January 18

MORNING SESSION

H. E. RODES, President, Presiding

10:00—Opening Remarks—President H. E. Rodes

10:15—Reports of the Regional Vice-Presidents on Business Conditions in 1936 and the Outlook for 1937:

Canadian Region—C. M. Doolittle
Eastern Region—A. S. Lane
Southern Region—T. I. Weston
Northern Region—N. E. Kelb
Central Region—J. A. Rigg
Southwestern Region—E. Eikel
Western Region—A. J. Wilson
Northwestern Region—P. W. Yett

10:45—Report of the Engineering Director—A. T. Goldbeck

11:15—Report of the Administrative Director—J. R. Boyd

11:45—General Discussion of Association Policies and Activities

12:15—Announcement of Convention Committees

Auditing
Resolutions
Nominating

12:25—Announcements

12:30—Adjournment

Monday, January 18

GREETING LUNCHEON

RUSSELL RAREY, Vice-President, Marble Cliff Quarries Co., Columbus, Ohio, Presiding

1:00—Everyone, including active and associate members, as well as guests, is cordially invited to attend.

Luncheon Address—Honorable Charles Sawyer, former Lieutenant-Governor of Ohio and Attorney-at-Law, Cincinnati, Ohio.

AFTERNOON SESSION

JOHN PRINCE, President, Stewart Sand and Material Co., Kansas City, Mo., Presiding

2:30—"The Use of 'Stone Sand' in Concrete Construction"—R. R. Litehiser, Chief Engineer, Bureau of Tests, Department of Highways, Columbus, Ohio.

3:00—Discussion.

3:15—"Methods of Preparation of 'Stone Sand' "—A general discussion led by

(a) Joseph Jackson, Carbon Limestone Co., Youngstown, Ohio.

(b) J. A. Rigg, Acme Limestone Co., Fort Spring, W. Va.

3:45—"What's On the Worker's Mind Today?"—Whiting Williams, nationally known Consultant and Adviser on Industrial Relations, Cleveland, Ohio.

4:15—Discussion.

4:30—"The National Industrial Council Library of Sound-Slide Films for Employee Meetings"—A representative of the National Industrial Council.

4:45—"Men and Machines"—A "picturized" answer (by means of sound-slide film) to the fallacy of technological unemployment.

5:15—Adjournment.

MONDAY EVENING

6:30—Informal Reception by the Manufacturers' Division to all in attendance at the Convention. The Reception will be followed immediately by a Buffet Supper at nominal cost.

8:00—Formal Opening of the Manufacturers' Division Exposition.

Tuesday, January 19

MORNING SESSION

N. E. KELB, Ohio and Indiana Stone Co., Indianapolis, Ind., Presiding

10:00—"Railroad Progress"—M. J. Gormley, Executive Assistant to the President, Association of American Railroads, Washington, D. C.

10:30—"The Use of Agricultural Limestone in the Federal Agricultural Conservation Program for 1937"—J. F. Cox, Senior Agronomist, Division of Program Planning, Agricultural Adjustment Administration, Washington, D. C.

11:00—Discussion.

11:15—"Silicosis—What it is and How to Prevent it"—Dr. R. R. Sayers, Medical Officer in Charge of Industrial Hygiene, U. S. Public Health Service, Washington, D. C.

11:45—"Legal Aspects of the Silicosis Problem"—Theodore C. Waters, Stockbridge and Waters, Baltimore, Md.

12:15—Discussion.

12:30—Adjournment.

Netherland Plaza Hotel

AFTERNOON

MANUFACTURERS' DIVISION LUNCHEON
followed by
AN AFTERNOON WITH THE EXHIBITORS

1:00—All in attendance at the convention are most cordially invited to be present at the luncheon.

"Greetings from the Manufacturers' Division"—C. S. Huntington, Link-Belt Co., Chicago, Illinois, Chairman.

"Response for the Association"—H. E. Rodes, President.

2:30—Inspection of the Manufacturers' Division Exposition.

Tuesday afternoon has been left open for the specific purpose of permitting those in attendance at the convention ample opportunity for a studious and leisurely inspection of the Exposition. There will be on display the latest developments in machinery, equipment and supplies used in the production of crushed stone. The various exhibitors have gone to great pains and substantial expense to make the Exposition both interesting and informative. You will be well repaid for the time you spend among the exhibits.

EVENING

8:00—Convention Cabaret

An informal evening of fun and frolic—entertainment features of exceptional merit—dancing between the acts and following the floor show.

Wednesday, January 20

MORNING SESSION

STIRLING TOMKINS, Vice-President, New York Trap Rock Corp., New York City, Presiding

10:00—Presentation of Awards for National Crushed Stone Association Safety Contest—W. W. Adams, Supervising Statistician, Employment Statistics Division, U. S. Bureau of Mines, Washington, D. C.

10:30—Remarks of Acceptance—Elmer Heise, Safety Engineer, Columbia Quarry Co., St. Louis, Mo.

10:45—"Significant Developments in Highway Investigations"—E. F. Kelley, Chief, Division of Tests, U. S. Bureau of Public Roads, Washington, D. C.

11:15—Stabilizing Quarry Fines for Base Construction"—C. L. McKesson, Vice-President, American Bitumuls Co., San Francisco, Calif.

11:45—"Low Cost Roads Will Multiply Stone Markets"—R. A. Giddings, Secretary, Calcium Chloride Association, Detroit, Mich.

12:00—Discussion

12:15—Adjournment.

AFTERNOON SESSION

OTHO M. GRAVES, President, General Crushed Stone Co., Easton, Pa., Presiding

2:00—"Future Policies in State and Federal Road Building"—W. C. Markham, Executive Secretary, American Association of State Highway Officials, Washington, D. C.

2:30—"Outlook for Federal Legislation Affecting Industry"—John C. Gall, Associate Counsel, National Association of Manufacturers, Washington, D. C.

3:00—Legislative Clinic

Undoubtedly many questions have arisen concerning the applicability to the Crushed Stone Industry of legislation enacted at the last session of Congress, particularly with regard to the Patman-Robinson and Walsh-Healey Acts. Ample time has, therefore, been afforded for a full discussion of this important subject. Mr. Gall, who is exceptionally well qualified to undertake this difficult assignment, will answer questions from the floor and those present are urged to take full advantage of this unusual opportunity to obtain his opinion on any points which may have proved confusing.

BUSINESS MEETING

H. E. RODES, President, Presiding

3:45—Report of the Auditing Committee.

4:00—Report of the Committee on Resolutions.

4:30—Report of the Nominating Committee—Election of Officers.

4:45—Greeting of President-Elect.

4:50—Adjournment.

WEDNESDAY EVENING

5:30 to 7:00—Presidential Reception to members and guests.

7:30—Annual Banquet.

Ladies Entertainment Program on Page 18.

The Crushed Stone Industry Under The Patman-Robinson Act

By JOHN C. GALL

Associate Counsel,
National Association of Manufacturers

IN THE flood of discussion which has followed enactment of the Patman-Robinson Act, there has been an inclination to forget that it is but another segment of our expanding business law or law merchant. There has been a tendency to interpret this Act in a legalistic manner sometimes far removed from the actual business practices to which it must be applied. Some of these practices, of course, are common to many trades and industries, but even when the attempt is made to discuss common problems, variations and differences soon appear, to challenge standardization or uniformity of treatment. There is no better method, therefore, in endeavoring to understand the implications of the Patman-Robinson Act, than to discuss its application to a specific industry in the light of its own particular practices and problems.

The crushed stone industry is not unique in presenting a combination of problems peculiarly its own. The industry is essentially local, with producers located in nearly all localities. Transportation costs are a large element in the ultimate cost of its products, and individual units in the industry are generally confined to a restricted competitive area. Consequently a large proportion of crushed stone is sold in local markets and fails to cross state lines. Even where interstate shipments are involved, the selling area is comparatively small and keenly competitive.

The importance to the crushed stone industry of this article by Mr. Gall can hardly be emphasized too strongly. It constitutes, so far as we are aware, the first comprehensive analysis made of the Patman-Robinson Act with specific regard to the crushed stone industry. It should prove illuminating and helpful. At the same time, we fully recognize that many questions will arise pertaining to the operation of the Act which cannot be anticipated. We have, therefore, timed the appearance of this article to precede immediately the annual convention in Cincinnati, at which time Mr. Gall, after giving a general review of the legislative situation, will conduct a legislative clinic. An exceptional opportunity thus will be afforded crushed stone producers in attendance at the convention to obtain the benefit of Mr. Gall's opinion concerning the application of the Act to specific problems. While not essential it would assist materially in the conduct of the legislative clinic if producers would submit their questions in advance to the Editor, thus permitting a more effective use of Mr. Gall's time at Cincinnati.

The sales practices in the crushed stone industry have a few outstanding characteristics. The great bulk of crushed stone is sold to contractors; not to dealers or ultimate users. The industry also sells in large volume to public agencies, federal, state and local. To these classes of buyers, as well as to contractors, sales are generally made after competitive bidding. Generally prices quoted are delivered prices, although many contractors may take delivery at the quarry. Except in metropolitan areas, there is no general uniform scale of prices in the industry, but prices tend to be established usually on the basis of each contract, and the conditions surrounding it.

Crushed stone is generally produced to order and to meet particular specifications as to kind, size and grade. Specifications often allow for alternative bids for different kinds of materials. Consequently, although limestone, granite, trap rock, and sandstones may have uses peculiar to each, all types may be competitive on particular contracts. Prices may vary with different stone, and also on different sizes of the same stone.

This brief description of the crushed stone industry discloses certain major problems for consideration under the Patman-Robinson Act:

First, the extent to which the Act applies to members of an industry engaged primarily in local commercial transactions. Second, the effect of the Act on a system of competitive bidding, characterized by keen price competition and fluctuating prices. Third, the effect of the law on a mixed system of selling

f. o. b. quarry in some instances and on a delivered price basis in others. Fourth, the significance under the Act of selling according to specifications of the buyer for stone of varying kinds, grade and sizes. While these general problems can be stated in simple language, the language of the law is by no means clear in indicating the answers.

Interstate vs. Intrastate Commerce

The Patman-Robinson Act declares it unlawful for any person *"engaged in commerce, in the course of such commerce"* to discriminate in price between different purchasers of commodities of like grade and quality *"where either or any of the purchases involved is in commerce."*

The status of a producer who does a local business exclusively is relatively clear. The Act applies to "any person engaged in commerce", meaning interstate or foreign commerce. It does not apply to any person not so engaged. Consequently, a producer who sells no stone in interstate commerce is not subject to the provisions of the Act applicable to sellers.

Even here, however, there may be some difficulty in ascertaining the scope or meaning of interstate commerce. It would not necessarily follow that, because all sales are made f. o. b. quarry, such transactions would not constitute interstate sales. This may be only a method of price quotation or of billing. The real character of the transaction would be determined by other factors. If orders were solicited in other states, or accepted for shipment to other states, the mere fact that the purchaser paid freight, or assumed risk and acquired title in transit would not be the controlling factor. As the Supreme Court has said:

"Ordinarily the question whether particular commerce is interstate or intrastate is determined by what is actually done, and not by any mere billing or plurality of carriers, and where commodities are in fact destined from one state to another, a rebilling or reshipment en route does not of itself break the continuity of the movement or require that any part be classified differently from the remainder. As this court often has said, it is the essential character of the commerce, not the accident of local or through bills of lading, that is decisive." (*Western Oil Refining Co.* v. *Lipscomb*, 244 U. S. 346, 349.)

Each transaction must be judged on its own facts. As the Supreme Court said in *Federal Trade Commission* v. *Pacific States Paper Trade Assn.*, 273 U. S. 52, 64:

"And what is or is not interstate commerce is to be determined upon a broad consideration of the substance of the whole transaction. Such commerce is not confined to transportation, but comprehends all commercial intercourse between different States and all the component parts of that intercourse. And it includes the buying and selling of commodities for shipment from one State to another. The absence of contractual relation between the manufacturer and retailer does not matter. The sale by the wholesaler to the retailer is the initial step in the business completed by the interstate transportation and delivery of the paper. Presumably the seller has then determined whether his source of supply is a mill within or one without the state. If the contract of sale provided for shipment to the purchaser from a mill outside the state, then undoubtedly it would be an essential part of commerce among the states. Clearly the absence of such a provision does not affect the substance of the matter when in fact such a shipment was contemplated and made. The election of the seller to have the shipment made from a mill outside the state makes the transaction one in commerce among the states. And on these facts the sale by jobber to retailer is a part of that commerce."

The language which has created real confusion over the scope of the Patman-Robinson Act is the phrase "where either or any of the purchases involved are in commerce."

For the purpose of clarifying this language, let us consider the situation of a producer who sells crushed stone to contractors or dealers in other states as well as to purchasers in the same state where the quarry is located. The question immediately arises whether the Patman-Robinson Act applies to those sales of stone to purchasers within the state and which do not involve or contemplate the shipment of the stone into another state. To determine whether the law affects such transactions, let us assume that the producer sells his local customers stone of the same kind, grade, quality and size at prices lower than those exacted from purchasers located in other states. On the basis of these facts we have a price differential between two customers, favoring the local purchaser. If the differential could not be justified on some basis allowed in the Act, it would probably be an unlawful discrimination. This obviously was the intention of Congress. According to the report of the House Judiciary Committee such price discriminations as between purchasers were to be prohibited because:

"When granted by a given seller to his customers in other States, and denied to those within the State, they involve the use of that interstate commerce to the burden and injury of the latter. When granted to customers within the State and denied to those beyond, they involve conversely a direct resulting burden upon his interstate commerce with the latter. Both are within the proper and well-recognized power of Congress to suppress."

As previously indicated, the Act forbids any person engaged in interstate commerce to discriminate in price in the course of such interstate commerce. A producer doing both local and interstate business is certainly "engaged in commerce" with respect to sales of crushed stone across state lines. It might be argued, however, that the price which gives rise to the discrimination occurs in a local sale over which the Federal government has no authority. This may well be, but as a legal matter, the law does not purport to regulate intrastate transactions. It simply recognizes that at least two sales are necessary before any discrimination can result to one purchaser, and that Congress may prohibit practices which discriminate against interstate commerce.

The reverse of the situation discussed above has been the subject of considerable controversy. The view has often been expressed that where the lower price is charged the interstate purchaser, there could be no burden on interstate commerce, and consequently Congress could not prohibit price discriminations against purchasers in local intrastate sales. This is not the time or place to add confusion by discussion of controversial constitutional issues. It should be pointed out, however, that if we adopt a consistent interpretation of the Act, there is no attempted regulation of intrastate sales. The courts might very readily hold that Congress can prohibit the use of interstate commerce to discriminate against intrastate transactions where the discrimination might tend to promote a monopoly, substantially lessen competition, or injure, destroy or prevent competition. So far as a producer of crushed stone, carrying on both local and interstate business, is concerned, the safer course would seem to dictate caution with respect to all sales, thus being in a position at all times to justify differentials that might be questioned by the government or by private litigants claiming financial injury.

We have already emphasized the fact that the law does not prohibit all price discrimination, but only those granted by persons engaged in trade and commerce between states. It is of equal importance that the Act prohibits a discrimination in price only between different purchasers of commodities of "like grade and quality".

Differences in Grade and Quality

The Patman-Robinson Act prohibits a discrimination in price between purchasers of commodities of like grade and quality. It has no bearing whatever on transactions whether local or interstate, involving the sale of commodities of different grade or quality, and where the articles are different the Act does not require that prices for different articles conform to a difference in cost of producing, selling or delivering such articles to the purchasers. In this respect, the Patman-Robinson Act represents a change over prior law embodied in the original Section 2 of the Clayton Act. That Section prohibited price discriminations but expressly sanctioned differences in price made on account of differences in the grade, quality, or quantity of the article sold. This change is important only because it is now certain that where two commodities are of different grade and quality there is no necessity for justifying a different price for one on the ground of a difference in cost of producing, selling or delivering the two different commodities.

Neither the Patman Act nor the original Section 2 of the Clayton Act attempted any clarification of the phrase "grade and quality." Such an effort would have been futile. There is no simple standard or simple rule by which any two products can be compared, to ascertain whether they are of like or different grade and quality. In my opinion the only practical approach is to consider the practice and understanding of the particular industry and its customers.

The variety of products of the crushed stone industry, together with the varied sizes and grades of crushed stone, makes the question of grade and quality a problem of singular importance. Does the law require a producer to establish uniform prices on all kinds of stone sold in like quantities? Or, if it sanctions different prices for different stone, does it require that these prices shall vary only as costs vary? Or, can it be said, for example, that limestone is an entirely different product than sandstone and consequently that prices on the two products cannot be compared to determine whether a discrimination in price has been made under the Patman-Robinson Act? These and similar questions also arise in connection with different sizes and grades of each par-

ticular kind of stone. To illustrate, may different prices be established for hard and soft stone of the same class, or, may prices vary according to variations in size of stone from coarse grades to fine? If these price variations are permitted, even though costs of manufacture, sale and delivery are uniform, does the law permit substitution of better grades for poorer at prices quoted for the latter? These are merely a few of the many problems facing this industry in connection with the question of identifying products of like or different grade and quality.

If different kinds of stone, or different sizes and grades of the same stone, were not often directly competitive, or capable of substitution one for another, the conclusion would seem clear that separate prices could be established for different stone and for different sizes or grades of the same product. We would have similar products, undoubtedly, but produced and purchased for different uses and purposes. Under such circumstances, it would probably follow that this would be a sufficient basis for classifying stone as of different grade and quality. Should a different result be reached merely because one stone may serve the same purpose as another, or because in certain instances different sizes may be used interchangeably?

In my opinion chief reliance must be placed on the custom and practice of this industry. If as a fact one type of stone, for example, is recognized generally by the industry and its trade as having peculiarities which make it more adaptable to certain uses than another, then I believe it can be treated as a different product and carry its own price, irrespective of the price of substitutes, good or bad, and regardless of the fact that in some specifications the two products might be used interchangeably. This would apply to the various aggregates or even synthetics. Any other conclusion would ignore the varying supplies of different stone available in any given area, and there is nothing in the Patman-Robinson Act which prohibits a scale of prices for different kinds of stone based on economic factors such as supply and demand.

Having established different prices for different kinds of crushed stone, there remains the problem of price variations between different sizes or grades of the same kind. This problem, likewise, in the absence of a better criterion, must be answered on the basis of common understanding and practice of the industry within a given competitive area. If custom has developed a system of grading stone according to degree of fineness, and has attached different values to different sizes, it would be my opinion that this practice would not be disturbed by the Patman-Robinson Act. In the absence of any legislative guide as to those characteristics which render similar products "commodities of like grade and quality", the practice of the industry in grading stone according to size is the best test available that stone of different size is of different grade. Consequently, in my opinion, the law would not prohibit different prices for different sizes recognized by the industry as standard grades.

It should be emphasized, however, that where different prices are established for different kinds of stone and for various grades or sizes of the same stone, such a classification should be carefully followed. A producer substituting a finer grade at the price generally charged by him for a coarse grade might be open to complaint of discriminating between customers. In many instances, however, the substitution of one grade for another, or higher priced stone for one of lower quality, may present a special problem. I have in mind particularly the situation where the contract specifications would permit the supplying of two or more different kinds of stone, or even sand and gravel. Under such circumstances we have the problem of products of different grades and of different regular prices actually in competition. With these facts present, would a producer be justified in furnishing a higher priced stone below his established price, or would this constitute a discrimination against customers who regularly purchase such high grade stone at the higher established price. This presents the problem of meeting competition, to which we now turn.

Meeting Competition

The problem of meeting competition is one of particular importance in the crushed stone industry, first because of its localized nature and second because of the class of purchasers to which it sells the great bulk of its products. While natural forces may account for localizing production, relatively high cost of transportation tends to restrict the market of any single producer. Consequently, in a given area, competition may be more intensive, and at many points becomes possible only by absorption or adjustment of transportation costs. This presents the problem of delivered prices with its many variations.

Since a large proportion of crushed stone is sold to contractors and public agencies, a distinctive method of doing business has developed, presenting many special problems. The private buyer himself

is generally in active competition and is constantly under pressure to obtain the most favorable prices and terms available. With both public and private purchasers, the system of competitive bidding is quite widely used. The products of the industry are generally purchased either for specific jobs or for specific uses, and the extent of the competition engendered depends upon the nature of the buyer's specifications. Often these specifications, by establishing certain tolerances, or allowing alternative bids, bring into active competition not only stone of different quality and grade, but also certain aggregates such as gravel and slag. Consequently in many instances it is not merely a problem of price competition between products of like grade and quality, but competition between different products capable of substitution on a particular contract.

With all of these forces, it is inevitable that certain price fluctuations should result, and that different purchasers should pay different prices for products of like grade and quality, even when purchased in like quantities. While other factors may justify these differentials, we are concerned here merely with the possible justification that the lower price in any comparable transaction was made in good faith to meet competition.

The Patman-Robinson Act, in Section 2(b), provides that in Federal Trade Commission proceedings, proof that a price discrimination has been granted creates a *prima facie* case that the law has been violated. It then provides that any person complained against may rebut that *prima facie* case by presenting affirmative evidence that the alleged discrimination was justified. It is further provided that this presumption may be overcome by showing that the lower price in question was made in good faith to meet the equally low price of a competitor. It is this provision which sanctions lower prices in exceptional cases to meet competition. A few brief observations may be pertinent at this point to throw light on the meaning of this provision.

This provision permits a lower price to meet the equally low price of a competitor. It justifies a lower discriminatory price only to meet a competitor's price. It implies, therefore, both the existence of a competitor's price below your own established prices, and knowledge by you of what that price is. This knowledge may be circumstantial, based on other sales by a particular competitor and on the justifiable premise that he will not himself quote a discriminatory price. With these conditions present, it then may sanction a reduction of your own price in a particular transaction to place your product on a price equality with your competitor or competitors seeking the particular order involved. It does not specifically sanction a price reduction *below* your competitor's price, nor does it *require* a *general* price reduction effective as to future transactions, either with the same purchaser or others. It permits you to meet actual competition, not imaginary; and places upon you the burden of proving the existence of the competition you purport to meet.

While this provision apparently applies only to proceedings before the Federal Trade Commission, there is ample reason to assume that the same defense would be available in any private suit for treble damages alleged to have resulted from a discriminatory price. Private actions are authorized under Section 4 of the Clayton Anti-trust law at the instance of any person injured by a discrimination in price made unlawful in Section 2(a) of the Act. However, a discrimination in price is not unlawful under Section 2(a) if it can be justified for some reason recognized by law. Among these justifications is the provision allowing lower prices to meet a competitor's price, and it is inconceivable that what would not be unlawful in a proceeding brought by the Federal Trade Commission would be unlawful if presented on the same facts in private litigation. While there are other reasons to support this conclusion, this is adequate to develop the nature of the so-called defense of meeting competition. The real difficulty lies in applying it to the various situations already suggested.

First, let us consider the problem of a producer who, in order to obtain business in a distant market, must absorb all or part of transportation costs. If the producer usually sells f. o. b. quarry and requires his customers to pay freight or other transportation costs, would he be discriminating against the customers by paying or absorbing such costs, or by actually delivering the stone without cost, on sales to more distant purchasers? If, on the other hand, the producer generally sells on a delivered price basis, quoting all prices on the basis of delivery to the project, would a discrimination in price result from absorbing a greater share of transportation costs to some purchasers than to others? These questions are further complicated because some sales are made in open market while others may be made only after secret competitive bidding.

The problem of delivered prices in itself raises troublesome questions under the Patman-Robinson Act. A few general observations on this problem

alone may clarify our approach to the specific questions posed above.

The Act itself makes no reference to delivered prices as such. It does, however, prohibit both direct and indirect price discriminations. It is possible, therefore, that an indirect price discrimination might result from different treatment to different purchasers in the matter of absorbing transportation costs. In my opinion, however, this does not mean that all uses of delivered prices are unlawful.

Delivered prices become vulnerable when they vary as between different purchasers. Where such variations occur, it might then become necessary to justify any difference on the basis of actual cost of transportation. This seems to me essentially the position of delivered prices in the crushed stone industry. A producer may sell some purchasers f. o. b. quarry, and the purchaser either pays freight or other cost of transportation, or does his own trucking. On some contracts the producer may be compelled to quote prices delivered at a particular destination. As between f. o. b. sales and sales on a delivered price basis, there would seem to be little danger of unlawful discrimination in actual practice so long as the difference between an f. o. b. price and a delivered price approximates actual cost of transportation.

The real danger of discrimination would occur in transactions with customers who purchase on a delivered price basis. For example, two dealers competing in the resale of a producer's stone are located at equal distances from the quarry, and purchase stone of like grade and quality in like quantities. Let us assume that the producer desires to favor one dealer by absorbing part of transportation costs so that this dealer pays $5. less per carload delivered than his competitor. This differential apparently could not be justified because of any difference in cost and very likely would constitute an unlawful discrimination. The same possibility might exist in sales to purchasers located at different distances when, by absorbing a greater portion of transportation cost, the producer actually reduces the amount one customer pays for his product below the price paid by another customer to an extent greater than could be justified by any difference in costs. In other words, unless the producer uses a system of uniform delivered prices, he should be prepared to justify any differential between delivered prices in the same manner as he would in case of variations in f. o. b. prices.

In the crushed stone industry, however, because it is essentially localized both in production and in its market, it often happens that two producers may be competing for a contract calling for delivery at a point nearer the plant of one than the other. Under such conditions competition would be impossible unless this natural advantage could be overcome. This presumably can be done by absorbing part of transportation costs or by reducing the basic price of the stone. In either event, the law would seem to require that the lower delivered price must be made in good faith to meet the equally low delivered prices of the particular competitors involved. In many cases this provision might be adequate, particularly in open market transactions when the various competitors are known, as well as their respective prices. It would not seem adequate when these facts are not known, as would be the case if secret competitive bids were required by the prospective buyer. This problem of competitive bidding merits separate treatment and will be discussed later.

In discussing the problem of grade and quality, we have already suggested the possible difficulty presented when stone of different kind, quality, or grade may become competitive on a particular project due to the buyer's specifications. In discussing the problem of meeting competition we have considered primarily the question of direct price competition between producers competing for the sale of stone of like quality, kind and grade. What of the situation where competition can be met only by supplying a higher quality or better grade of stone at a price comparable to that usually received for stone of lower quality and grade? One example will suffice to illustrate the problem. A contractor's specifications call for bids on stone or competing aggregates amounting to one hundred cubic yards with a specified minimum weight per cubic yard. In view of price competition from low quality stone or gravel and slag, could a producer quote fine quality granite, meeting the minimum weight requirements, at a price comparable to the price of the lower grade products? In my opinion this kind of competition would be legitimate under the Patman-Robinson Act, subject of course to the limitations we have already discussed. Where any products come into actual competition, regardless of their relative quality, grade or value when used for other purposes, the producer offering the better grade could meet the competition from lower quality products by reducing his price to equal that of the competing products. Under such circumstances, however, that producer

should be in a position to justify the reduction as made in good faith to meet lower prices of his competitors. Where the potential competitors are unknown, or their prices are not made available, such as would be the case under a system of competitive bidding, the problem of proof would be almost insuperable. Let us consider, therefore, the whole question of competitive bidding to ascertain whether some of the problems already discussed, but apparently unanswerable by reference to any specific provision of the law, may have their solution in this method of selling.

Competitive Bidding

We have seen that the tendency to quote below established prices on contracts requiring competitive bidding would be difficult to justify on the theory of meeting competition in the precise manner permitted in the Patman-Robinson Act solely because of difficulty of proof. It is also doubtful whether lower prices on such contracts could be justified to their full extent because of provable differences in costs of production, sale or distribution due to different quantities sold or because sold or delivered by a different method. The practice of competitive bidding raises the direct question of a price discrimination between two buyers with no apparent basis for justification under the Act. Must we conclude that competitive bidding is lawful only if each bidder quotes his established prices or varies them only to the extent he can prove a difference in costs? The answer is of vital importance to this industry.

Against this conclusion it should be pointed out that federal and state laws almost universally provide for purchasing the supplies of government through secret competitive bidding. These laws represent a fundamental purpose to further economy in public purchases; to give public agencies the advantage of active competition among sellers, and permit public buying at the lowest possible prices obtainable commensurate with quality. It can be argued with force and merit that this well established public policy cannot be presumed to have been superseded and cast aside by the Patman-Robinson Act, without specific consideration and rejection. The problem of competitive bidding was not even discussed during debate on this measure. Any apparent conflict between the Patman Act and laws requiring public purchases to be made only after competitive bidding will be reconciled to give effect, if possible, to both. If possible, the Patman Act will be construed to avoid such conflict and leave unchanged this established method of buying and selling.

On the other side, it may be argued that the purpose of statutes relating to public buying is not impaired by the Patman-Robinson Act. These statutes are designed to enable government agencies to buy at the lowest prices available in a competitive market. They are not intended to force price cutting on sales to the government. If each bidder quotes *his established prices*, there is still price competition and the government is still permitted to buy at the lowest price available to other purchasers. Such bidding would satisfy the purposes of laws relating to government purchases and at the same time keep within the letter and spirit of the Patman-Robinson Act. The principle underlying this Act is that a seller should not be permitted to take business from a competitor by selling at low prices to selected customers, presumably even the government, and making up his losses or margin of profit through sales to other buyers at higher prices.

If the issue were joined between these conflicting views on their merits, it would be hazardous to guess what the result might be. This law prohibits a discrimination in price which may tend to promote a monopoly, substantially lessen competition, or "to injure, destroy or prevent competition with any person who either grants or knowingly receives the benefit of such discrimination or with customers of either of them." Let us explore the possibility of competitive injury resulting from price discrimination occurring through a system of competitive bidding on either public or private sales.

First, would such a price discrimination injure, destroy or prevent competition with the buyer who knowingly receives the benefit of the discriminatory price? The answer would probably be in the negative, and for two reasons. In all probability the buyer would not have knowledge that the price he paid discriminated against other purchasers from the same producer. Furthermore, in all but exceptional cases there would be no possibility of injury to competition with the buyer. So far as public agencies are concerned, in their use of crushed stone they are not in competition with other users of the products of this industry. Private contractors may occupy a similar position. In some instances a private contractor buying materials for use on his contract is not in competition with another contractor. The materials are to be used on a project for which the buyer already has a contract. There is no competi-

tion between contractors for that project, and it is difficult to see any tendency to injure, destroy or prevent competition which does not exist. In most cases, however, the principal contract has not been awarded, and where various contractors are competing for the project, each estimate will be based in part on the prospective cost of materials. Under such conditions a producer of crushed stone would appear under obligation not to discriminate against any contractors competing for a particular project in quoting prices or terms. If this danger of discrimination is avoided, there would seem to be no other possibility of competitive injury to actual or potential customers of the producer. This is on the assumption, of course, that the contractors bidding for the contract are normally competitors in business generally, and not merely competing for one contract alone.

The law also prohibits a price discrimination which injures, destroys or prevents competition with other customers of the seller, or with customers of any purchaser who knowingly receives the benefit of a discriminatory price. In addition to the possibility of injury to competing contractors discussed above, a further danger may exist in a few instances of injuring competition with other customers of the seller. For example, the producer has regular dealer-customers who purchase crushed stone at established prices for resale to contractors or other users. Such a dealer may be in competition with the producer himself, and also with contractors who purchase from the same source. The first possibility of injury might arise when the producer and his dealer are bidding for the same contract. If the producer sells at a discriminatory price to a contractor, his own dealer may be injured thereby, and to the extent that the particular price injured competition between the dealer and the producer, there would probably be a violation of the Act.

Injury to competition with customers of a favored purchaser would seem to be remote. In the first place, these customers once removed must purchase from a direct customer who knowingly receives a discriminatory price from the producer. In the second place, most purchasers from a customer of a producer are not in competition. Contractors, who constitute perhaps the largest class of buyers in this industry are selling their own labor and materials to ultimate users who are not reselling the products of the crushed stone industry.

Finally, we must consider the possibility of injury to competition among producers of crushed stone resulting from a system of competitive bidding giving rise to inevitable price variations between different bids and different purchasers.

A contract for a large order of crushed stone is advertised, and five competing producers submit bids. The contract is awarded to the lowest bidder with the result that his four competitors lose the business. Assuming that the successful bidder made a special price on this contract, and could not justify the difference in price on this and other contracts on some basis allowed in the Patman-Robinson Act, would this price discrimination constitute a violation of the law? Is this a price discrimination which injures, destroys or prevents competition with the person who grants the discrimination as intended by the Act? In attempting to answer this question we are entering a field of pure speculation. The law itself can be construed either to sanction or condemn this kind of competitive injury. For my part, however, I am strongly inclined to believe that injury due to loss of business in the transaction described does not "injure, destroy or prevent competition" as contemplated by the Patman-Robinson Act.

While it is no longer necessary under the law that the injury to competition should be so severe as to substantially lessen competition generally, it is my opinion that something more than loss of a single contract must be proved to show violation of the Act. Just consider the competitive situation among bidders before or after a contract is awarded. The particular producers bidding on the contract may never have been in actual competition before, but may have been brought together in active competition for the first time. In all their other business they are not competitors; each may be serving his own particular market. Neither bidder loses business unless we consider that one can lose what he never had. After the contract is awarded the lowest bidder, these producers may never again be in actual competition for the same business. On the other hand, if they were actual competitors aside from this particular contract, competition between them for other business is not necessarily affected adversely because one obtains and the other loses a single contract.

This, in my opinion, indicates the only reasonable interpretation of the language "to injure, destroy or prevent competition" contained in the Patman-Robinson Act. It is not mere loss of a single contract, or loss of a single customer, but rather a succession of losses caused by a consistent policy of one

competitor to underbid other producers with prices lower than those he usually exacts from other purchasers in localities where competition is not so severe, or from his own established customers. The Act does not prohibit a discrimination in price which simply results in a competitor losing business. To be unlawful, the discrimination must tend to injure, destroy or prevent competition. Loss of a single order in itself may have no effect whatever on subsequent competition, whereas a continued loss of single orders through a consistent policy of cutting prices may have that result. I do not believe therefore, that in the normal case of competitive bidding, where the bid of each producer may be determined by numerous legitimate considerations, that the necessary injury to competition would exist to render the lower price of a particular producer an unlawful discrimination. Where, however, the producer consistently underbids his competitors, and cannot justify his own price variations on some basis recognized by law, it is quite likely that sufficient injury to competition could be proved to show violation of the Act.

This conclusion finds support in establishing principles of the law of unfair competition and in decisions involving "unfair methods of competition" prohibited in Section 5 of the Federal Trade Commission Act. The legal insignificance of isolated, infrequent acts was clearly recognized in the case cited below, where the court said:

"It is undoubtedly true, that a single act may constitute substantial evidence of an unfair method of competition. *Fox Film Corporation* v. *Federal Trade Commission* (C. C. A.) 296 F. 252. But when all the facts are considered in this case, there is no act or combination of acts which in our opinion can be given that effect. Saving the testimony of Tower referred to, which was denied by Schueler, the evidence shows that petitioners not only did not authorize their salesmen to disparage the products of their competitors, but expressly instructed them not to do so. Their policy, as disclosed in the evidence, was to sell their product on its merits, and not on the demerits of other like products. Proof that a salesman here and there out of many—as many as 600 at one time—spoke disparagingly of the product of a competitor (not more than a dozen times in all) does not amount to substantial evidence of an unfair method of competition." (*Philip Carey Mfg. Co.* v. *Federal Trade Commission*, 29 Fed. (2) 49.)

Unfair competition becomes actionable because it causes diversion of trade from competitors. If price discriminations are now to be prohibited, not only where they adversely affect the public interest by promoting monopolies or substantially lessening competition, but also where the only substantial injury is to a single competitor, then there is no better standard of illegal injury than that already outlined in the common law of unfair competition, or in decisions arising under the Federal Trade Commission Act.

Industry Attention Focuses on Cincinnati Excellent Attendance Anticipated For Annual Convention

(Continued from page 3)

will be available throughout the convention period.

The stage is all set for a fine convention in Cincinnati and every producer in the United States and Canada should make every possible effort to be present. If you have not yet returned to the Netherland Plaza Hotel the reservation card recently forwarded from this office, by all means do so today and thus make certain you will have just the type of accommodations desired.

John W. Stull

HIS many friends throughout the crushed stone industry will share our deep regret in learning of the death of Mr. John W. Stull, President of the Liberty Limestone Corp. of Rocky Point, Virginia. Mr. Stull was killed by a railroad train on the morning of December 2 though we are not informed at the time of this writing as to the details of the accident.

For many years a member of the Board of Directors of the Association and always an enthusiastic and ardent supporter of the Association's activities, Mr. Stull will be keenly missed in the ranks of crushed stone producers.

Our sincere sympathy is extended to his company and bereaved family.

Tests for Determining the Relative Suitability of Concretes for Highways[1]

By A. T. GOLDBECK

Engineering Director,
National Crushed Stone Association, Inc.

◆ Although the beam test is the most reliable measure of the quality of pavement concrete, it evidently is not to be accepted as an infallible indicator of relative service behavior. More investigations are needed to show the influence of various physical properties of concretes on their road-making qualities. The present paper points to the necessity for such investigations.

Crack Surveys

THAT concrete highways crack to different extents depending upon the coarse aggregate used is a matter of common observation. This is so in spite of the fact that the ordinary strength tests may not reveal any particular difference in results. One very notable example of this difference in extent of cracking of concretes made with different types of aggregate may be found in the Ohio Post Road, known as U. S. Route No. 40, extending from Zanesville, Ohio, west about 24 miles. This road was built in 1914 and 1915, part of it with gravel coarse aggregate and part of it with limestone. Careful crack surveys have been made by the United States Bureau of Public Roads[2] and have been reported upon in two publications; the first time in "Public Roads" after approximately ten years of service and the latest report in the September 28, 1933, issue of *Engineering News-Record*, the crack survey having been made in 1932, some seventeen to eighteen years after the road was completed. It is interesting to note that the compressive strengths and the modulus of rupture values of the respective concretes were each about alike as determined by specimens taken from the actual road. Yet the crack survey showed that whereas only 7 per cent of the 30 foot length slabs of gravel were free from cracking, 33 per cent of all of the limestone slabs were free from transverse cracks. Twenty-two per cent of the gravel concrete slabs showed two transverse cracks whereas only 5 per cent of the stone concrete slabs showed a similar number.

In the report of 1924, crack diagrams were published and measurements of these diagrams indicate that there were about 10,500 feet of cracks and joints in the gravel sections as against only 5,400 feet of cracks and joints in the limestone section, each section being about 9,000 feet long. Roughly, then, there was almost twice the length of cracking in the gravel sections as compared with the limestone sections in spite of practically identical strengths in both cases. Certainly, some property of these respective concretes other than strength must be taken into account in trying to determine the reason for this large difference in cracking.

Last year the writer had occasion to analyze the results of a crack survey made in the State of North Carolina. This survey involved 25 miles of crushed stone concrete in comparison with 25 miles of gravel concrete, both having closely comparable conditions. The crack survey was made by the use of a special crack measuring device designed and built in the laboratory of the National Crushed Stone Association. It is a device which can be attached to the running board of an automobile and involves a measuring wheel exactly ten feet in circumference which operates a revolution counter so geared to the measuring wheel as to indicate feet of length traversed by the measuring wheel.

Without going into detail it may be stated that:

(1) The average spacing of transverse cracks in the stone concrete is 90 feet and in the gravel concrete 60 feet.

(2) The average length of longitudinal cracking in the stone concrete is roughly 1/10 mile per mile of road and in the gravel concrete 3/10 of a mile to 4/10 of a mile per mile of road. None of these sections had a center longitudinal joint.

(3) The gravel concrete shows much more frequent cracking of a nature such as to produce comparatively small slabs and also corner breakage is more frequent in the gravel concrete than in the stone concrete.

[1] Presented before a meeting of the Pennsylvania Stone Producers Association held at Harrisburg, Pennsylvania, December 16, 1936.
[2] Public Roads, June, 1925.

(4) The gravel concrete shows more frequent "blow-ups" due to expansion.

The conclusions reached as the result of this survey were:

(1) Because of more frequent transverse cracking of the gravel concrete, it should have closer spacing of contraction joints than in the stone concrete.

(2) Because of the more frequent "blow-ups", more expansion joints are needed in the gravel concrete than in the stone concrete.

(3) The greater general frequency of cracking in the gravel concrete than in the stone concrete indicates a lower resistance to bending stresses when subjected to service conditions. This difference in resistance can be corrected in part at least either by the use of stronger gravel concrete or by greater thickness of gravel pavement or both.

Some years ago, the Highway Research Board made an investigation of the efficiency of reinforcing steel. As a result of his observations the special investigator employed on this project, in his report on the efficiency of the steel in the prevention of cracking, found it necessary to take into account the kind of coarse aggregate used. It was outstanding in that report that, as a whole, good crushed stone concrete pavements are superior in their resistance to cracking. A number of quotations could be taken from the report indicating the superiority of crushed stone over gravel as a coarse aggregate in concrete so far as its prevention of cracking is concerned. The following are typical.

An engineer of the New York State Highway Department stated, "Cracking has been greatly influenced by character of aggregates. In some cases at least, other conditions being equal, pavements in which certain uncrushed gravels have been used as the coarse aggregate, developed more transverse cracks than where broken stone was used."

Speaking of the roads in North Carolina it is stated, "Forty-three per cent crack reduction (by the use of reinforcing steel) would be expected in the same slab thickness when good crushed aggregate is used and but 24 per cent with the aggregate (gravel aggregate) requiring a 1:1½:3 mix, or a difference of 41 per cent."

Speaking of the Fair Grounds at St. Louis, it is stated, "The reduction (by the use of reinforcing steel) afforded with the gravel was but 57 per cent of that shown by the limestone."

Speaking of New York State, it is stated that the reduction with gravel aggregate was but 39 per cent of that secured with the limestone.

It is outstanding in this report that when reinforcing steel is used, crushed stone aggregate is far more effective in reducing cracking than is the case with gravel aggregate. Perhaps there may be exceptions to any such general statement for there are good gravels to be compared with rather poor stones, but it is believed that this condition is the exception. In view of the fact that the reinforcing steel in a concrete pavement serves mainly to hold the slabs together after cracking takes place a fair inference is that in the cases cited in the above mentioned report the difference in cracking noted was due largely to the coarse aggregates.

Laboratory Tests

Laboratory tests on concrete to determine its value for any particular purpose should be made to investigate that special quality of the concrete which is of paramount importance in connection with the use to which it will be put. Thus, concrete for supporting heavy loads, as in a column of a building should be tested in compression. Such concrete must have high compressive strength. If the concrete in an important structure is to be subjected to extreme conditions of weather exposure, obviously its durability should be investigated and freezing and thawing tests become of greatest importance. For many years concrete for highways was tested to determine its compressive strength, the thought being that the compressive strength test determined that particular quality of the concrete which was desired. A number of states, as a matter of fact, still make the compression test and accept this test as a measure of the concrete quality for highway construction.

Something over 15 years ago, as the result of extensive field and laboratory tests by the U. S. Bureau of Public Roads and also by the Illinois Department of Highways, it dawned upon highway engineers that concrete road slabs in reality are beams having considerable width. A road slab bends under each passing vehicle and bending stresses or internal forces are set up in the slab such as are produced in the floor beam of a building when the floor is loaded. Accordingly, engineers began to test concrete for highways in the form of beams instead of in the form of compression specimens. The beam strength became highly important in their minds as a desirable quality for highway concrete. They found that, although in a general way there is a relationship be-

tween the compressive strength and the beam strength of concrete, still, this was not a constant relationship but it depended to some extent upon the aggregate used.

It is a fact that extremely weak aggregate, those having a high percentage of wear in the several abrasion tests, will produce concrete having relatively low beam strength. Similarly, those aggregates which have low adhesion to the mortar will produce lower beam strength than is the case with aggregates having high adhesion. Smooth, siliceous gravels having low absorption are apt to have a weakening effect as contrasted with the rougher textured surfaces of crushed stone.

Various theories for the proper design of the cross-section of concrete highway were built up involving the use of the beam test. In the Illinois State Highway Department, and in other organizations, repeated load tests were made on concrete beams and it was discovered that concrete suffers fatigue; that is to say, if loads are repeated a large number of times, the concrete beam will break under a load much less than would be required to break it were the beam to be loaded only once. This property of fatigue is common, not alone to concrete, but it applies to practically every known material of construction, even including the best grades of steel. It becomes a highly important property in the design of machinery and of moving parts, such as railroad car axles.

The Illinois tests and those of other research laboratories were made in recognition of the fact that concrete highways are subjected to many thousands of applications of load during the life of the structure. Not only is the slab bent by passing motor vehicles, but it is continuously in motion due to changes of temperature and of moisture and to changes of subgrade support from various causes. Important roads may be subjected to hundreds of thousands of repetitions of bending during the course of a few weeks.

The procedure in making standard beam tests is to make the concrete beam specimen in a standardized manner, then cure it under standard conditions of moisture and temperature and finally, at the end of 28 days, it is mounted in a testing machine and subjected to load, slowly and without shock until failure takes place. The specimen is very carefully handled and the load is applied only once. The concrete in a road, however, receives far different action, for, as above stated, there are numerous applications of load, perhaps millions of them, before finally a load comes along which is heavy enough to break the concrete in its fatigued condition. Does it not seem reasonable to suppose that this preliminary stressing which the concrete receives in an actual roadway might possibly have a different effect on different concretes depending upon the kind of aggregate employed? Is it not probable that the standard beam test with its single load application with no pre-stressing before failure may not reveal the difference in actual service value of the respective concretes?

The beam test undoubtedly at the present time is the best test we have for highway concrete, but by no means is it to be accepted as the ultimate test for the service value of the respective concretes used in highways. There are too many instances of concretes having approximately the same beam strength but showing entirely different results in service. Something happens in service which the beam test does not always indicate. It is with these thoughts in mind that we have been endeavoring to discover how to test highway concrete in a manner which will be more nearly indicative of the true respective merits of concretes containing different aggregates.

We have been investigating in our laboratory the possible effects of different aggregates on the resistance of the concrete to repeated load. As a start in this direction we used concrete made with 6 bags of cement per cubic yard, one batch containing Potomac River gravel and the other, Martinsburg limestone. The concrete was about 9 months old when placed in our testing machine. The modulus of rupture of the stone concrete was 944 lbs. per sq. in. and of the gravel concrete 837 lb. per sq. in. Seven beams made with the gravel concrete and six with stone concrete were then placed end to end around the circumference of our circular track. The beams were supported on knife edges made from ½ inch steel rods and the span length was so adjusted that the wheel loads produced a stress of 440 lb. per sq. in., which was almost 53 per cent of the modulus of rupture of the gravel concrete. This same stress is something over 46 per cent of the modulus of rupture of the stone concrete. The wheel was started rolling slowly at about 2 miles per hour and 3 of the gravel beams broke at only 27, 28 and 170 revolutions, respectively. None of the stone beams broke at this early period. It was then decided to find out what strength the remaining beams had after this small number of repeated loads.

Accordingly, a number of the unbroken beams were taken out of the circular track and tested under

slowly applied load. The average modulus of rupture of the 3 stone beams was 624 lb. per sq. in. and of 4 gravel beams,—586 lb. per sq. in. Both the stone and the gravel concrete beams had been reduced in strength by this extremely small number of applications of load. The indications are then that concrete in a highway, after the passage of only a few vehicles producing a not unusual stress, suffers reduction in strength and by no means does it have the modulus of rupture indicated by beam specimens tested in the standard manner. The three remaining stone concrete beams were then again subjected to repeated loads in the circular track and one beam broke at 1,082 revolutions, another at 2,563 and a third did not break even after 6300 revolutions. This unbroken beam was taken from the testing machine and put in our beam machine where it was broken with an indicated modulus of rupture of 585 lb. per sq. in., a stress which is not so very much higher than the 440 lb. per sq. in. produced by the rolling load.

The interesting point about this test so far as stone and gravel are concerned is the fact that the slightly higher modulus of rupture shown by the stone concrete as compared with the gravel concrete when tested under a single load application was still enough to produce very much higher reistance in the stone concrete than in the gravel concrete, when subjected to repeated rolling loads of a magnitude just a little more than half of the load, which will cause failure of the gravel concrete when applied once. The indications are that this particular stone concrete resisted roughly some 400 times as many load applications as the gravel concrete before failure. These results are not to be taken as final or conclusive. They are merely indications of a possible line of investigation which may more nearly show the true relative worth of stone and gravel concrete. Certainly, this method of attacking the problem of discovering how to determine the relative worth of different concretes gives enough promise to encourage us to continue further and we are now producing the necessary concrete specimens for this purpose. Perhaps the true significance of small differences in modulus of rupture in their effect on resistance to repeated loads is not sufficiently appreciated.

Another line of investigation includes impact tests. We have built an impact machine and have already made a number of investigations. The difficulty thus far has been to obtain results which will check one another closely enough. We do not know whether this trouble in testing procedure can be overcome.

Still another line of possible attack involves expansion and contraction measurements of concrete made with different aggregates and includes also a theoretical analysis, making use of the expansion measurements thus obtained. The effect of repeated freezing and thawing on beam strength also needs investigation.

We certainly are not satisfied that either the compression test or the simple beam test determines the quality of highway concrete and until we can obtain parallel behavior in the laboratory and in service we cannot be certain that we have developed a quality test for concrete for use in highways. The repeated load tests which we have thus far made at least give promise of producing valuable information.

Unfortunately, investigational work cannot be done over-night. It frequently becomes necessary to make a series of investigations to discover how to proceed with further testing in the proper manner. Any sort of exploratory work is a slow, painstaking job, but the facts when produced are generally well worth the effort expended in developing them.

LADIES' ENTERTAINMENT PROGRAM

NATIONAL CRUSHED STONE ASSOCIATION
Cincinnati, Ohio
January 18-20, 1937

MONDAY, JANUARY 18

9:30 A. M.	Registration.
10:00	Opening of Convention.
1:00 P. M.	Greeting Luncheon.
3:00 to 5:00	Get-Acquainted Tea in Ladies' Headquarters.
8:00	Theatre Party (assemble in Ladies' Headquarters).

TUESDAY, JANUARY 19

12:30 P. M.	Luncheon at the Alms Hotel followed by visits to Taft Museum and Rookwood Pottery (assemble in Ladies' Headquarters at 12:00).
8:00	Convention Cabaret. An evening of entertainment and dancing to which the ladies are especially invited.

WEDNESDAY, JANUARY 20

12:30 P. M.	Luncheon—Netherland Plaza Hotel followed by bridge.
5:30 to 7:00	Presidential Reception.
7:30	Annual Banquet.

LIST OF EXHIBITORS

Manufacturers' Division Exposition

in conjunction with

The Twentieth Annual Convention

of the

National Crushed Stone Association

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Atlas Powder Co., Wilmington, Del.
Bucyrus-Erie Co., South Milwaukee, Wis.
Cross Engineering Co., Carbondale, Pa.
E. I. duPont de Nemours and Co., Wilmington, Del.
Easton Car and Construction Co., Easton, Pa.
Frog, Switch and Mfg. Co., Carlisle, Pa.
General Electric Co., Schenectady, N. Y.
Gruendler Crusher and Pulverizer Co., St. Louis, Mo.
Hardinge Co., York, Pa.
Harnischfeger Corp., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.
Hercules Powder Co., Wilmington, Del.
Jeffrey Mfg. Co., Columbus, Ohio.
Kennedy-Van Saun Mfg. and Eng. Corp., New York City.
Kensington Steel Co., Chicago, Ill.
Koehring Co., Milwaukee, Wis.
Lima Locomotive Works, Lima, Ohio.
Link-Belt Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, Ohio.
National Safety Council, Chicago, Ill.
Nordberg Mfg. Co., Milwaukee, Wis.
Northwest Engineering Co., Chicago, Ill.
Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.
Pit and Quarry, Chicago, Ill.
Robins Conveying Belt Co., New York City.
Rock Products, Chicago, Ill.
Simplicity Engineering Co., Durant, Mich.
The Thew Shovel Co., Lorain, Ohio.
Traylor Engineering & Mfg. Co., Allentown, Pa.
W. S. Tyler Co., Cleveland, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
U. S. Bureau of Mines, Washington, D. C.
U. S. Bureau of Public Roads, Washington, D. C.

MANUFACTURERS' DIVISION

of the

NATIONAL CRUSHED STONE ASSOCIATION

These associate members are morally and financially aiding the Association in its efforts to protect and advance the interests of the crushed stone industry. Please give them favorable consideration whenever possible.

Allis-Chalmers Mfg. Co.
Milwaukee, Wis.
Crushing, Screening, Washing, Grinding, Cement Machinery; Motors; Texrope Drives; Centrifugal Pumps; Tractors

American Bitumuls Co.
200 Bush St., San Francisco, Calif.
Bitumuls—Hot and cold mixes, Penetration and Stabilization

American Cyanamid & Chemical Corp.
Explosives Department
Koppers Building, Pittsburgh, Pa.
Explosives and Blasting Supplies

American Manganese Steel Co.
389 E. 14th St., Chicago Heights, Ill.
Manganese Steel Castings, Renewable Lip Dippers

American Sealdrok, Inc.
135 S. LaSalle St., Chicago, Ill.

Atlas Powder Co.
Wilmington, Del.
Industrial Explosives and Blasting Supplies

The Barber Co., Inc.
1600 Arch Street, Philadelphia, Pa.
Asphalts for all Types of Street and Highway Construction and Maintenance

The Barrett Co.
40 Rector Street, New York City
Tarvia and Tarvia-lithic for Road Construction, Repair and Maintenance

Bucyrus-Erie Co.
South Milwaukee, Wis.
Excavating, Drilling and Material Handling Equipment

C. G. Buchanan Co.
90 West Street, New York City
Primary, Secondary and Finishing Crushers and Rolls

Chain Belt Co.
1600 W. Bruce St., Milwaukee, Wis.
Conveying and Elevating Machinery, Drive Chains, Spray Nozzles, Central Mixing Plants, Truck Mixers, etc.

Cross Engineering Co.
Carbondale, Pa.
Screen Plates and Sections, Perforated Metal

E. I. du Pont de Nemours & Co., Inc.
Wilmington, Del.
Explosives and Blasting Accessories

Easton Car and Construction Co.
Easton, Pa.
Quarry Cars, Truck Bodies and Trailers
Electric Heaters for Tar, Asphalt or Bitumen

Ensign-Bickford Co.
Simsbury, Conn.
Cordeau-Bickford Detonating Fuse and Safety Fuse

Frog, Switch & Mfg. Co.
Carlisle, Pa.

General Electric Co.
1 River Road, Schenectady, N. Y.
Electric Motors

Goodyear Tire & Rubber Co.
Akron, Ohio
Belting (Conveyor, Elevator, Transmission), Hose (Air, Water, Steam, Suction, Miscellaneous), Chute Lining (Rubber)

Gruendler Crusher and Pulverizer Co.
2915 N. Market St., St. Louis, Mo.
Rock and Gravel Crushing and Screening Plants, Jaw Crushers, Roll Crushers, Hammer Mills, Lime Pulverizers

Hardinge Co., Inc.
York, Pa.
Scrubbers, Pulverizers, Dryers

Harnischfeger Corp.
4400 West National Ave., Milwaukee, Wis.
A complete line of Power Excavating Equipment, Overhead Cranes, Hoists, Smootharc Welders, Welding Rod, Motors and Generators

Hayward Co.
50 Church Street, New York City

Hendrick Mfg. Co.
Carbondale, Pa.
Perforated Metal Screens, Perforated Plates for Vibrating and Shaking Screens, Elevator Buckets, Hendrick Vibrating Screens

Hercules Powder Co.
Wilmington, Del.
Explosives and Blasting Supplies

Illinois Powder Mfg. Co.
1752 Pierce Bldg., St. Louis, Mo.
Gold Medal Explosives

The Jeffrey Mfg. Co.
Columbus, Ohio
Material Handling Machinery, Crushers, Pulverizers, Screens, Chains

Kennedy-Van Saun Mfg. and Eng. Corp.
2 Park Ave., New York City

Kensington Steel Co.
505 Kensington Ave., Chicago, Ill.
Manganese Steel Castings, Dipper Teeth, Crawler Treads, Jaw Plates, Concaves and Hammers

Koehring Co.
3026 W. Concordia Ave., Milwaukee, Wis.
Mixers, Pavers, Shovels, Cranes, Draglines, Dumptors, Traildumps, Mud-Jacks

Koppel Industrial Car and Equipment Co.
Koppel, Pa.
A complete line of cars for quarry service.

Lima Locomotive Works, Inc.
Shovel and Crane Division
1108 Lima Trust Bldg., Lima, Ohio
Power Shovels, Draglines and Cranes

Link-Belt Co.
300 West Pershing Road, Chicago, Ill.
Screening, Washing, Conveying Equipment

Ludlow-Saylor Wire Co.
Newstead Ave. & Wabash R. R., St. Louis, Mo.
Woven Wire Screens and Wire Cloth of Super-Loy, Manga-Loy and all commercial alloys and metals

Marion Steam Shovel Co.
Marion, Ohio
A Complete Line of Power Shovels, Draglines and Cranes

Nordberg Mfg. Co.
Milwaukee, Wis.
Cone Crushers, Vibrating Screens, Classifiers, Diesel Engines, Steam Engines, Compressors, Mine Hoists, Underground Shovels, Track Maintenance Tools

Northern Blower Co.
65th St. south of Denison, Cleveland, Ohio
Dust Collecting Systems, Fans—Exhaust and Blowers

Northwest Engineering Co.
28 E. Jackson Blvd., Chicago, Ill.

Pioneer Gravel Equipment Mfg. Co.
1515 Central Ave., N. E., Minneapolis, Minn.
Jaw Crushers, Roll Crushers, Horizontal Gradation Screens, Inclined Vibrating Screens, Revolving Screens, Belt Conveyors, Belt Conveyor Units, Quarry and Rock Plants

Pit and Quarry Publications
538 South Clark St., Chicago, Ill.
Pit and Quarry, Pit and Quarry Handbook, Pit and Quarry Directory

Robins Conveying Belt Co.
15 Park Row, New York City
Belt Conveyors, Bucket Elevators, Gyrex and Vibrex Screens, Feeders, Design and Construction of Complete Plants

Rock Products
205 West Wacker Drive, Chicago, Ill.

Simplicity Engineering Co.
Durand, Mich.
Simplicity Gyrating Screen, Simplicity D'centegrator, Simplicity D'watering Wheel

Taylor-Wharton Iron & Steel Co.
High Bridge, N. J.
Manganese and other Special Alloy Steel Castings

The Texas Co.
135 E. 42nd St., New York City

The Thew Shovel Co.
Lorain, Ohio
Power Shovels, Cranes, Crawler Cranes, Locomotive Cranes, Draglines. Diesel Electric, Gasoline. 3/8 to 2-1/2 cu. yd. capacities

The Traylor Engineering & Mfg. Co.
Allentown, Pa.
Stone Crushing, Gravel, Lime and Cement Machinery

Troco Lubricating Co., Inc.
2728-34 N. Salmon St., Philadelphia, Pa.
Troco Crusher Grease, Troco Safety Lubricants

Trojan Powder Co.
17 N. 7th St., Allentown, Pa.
Explosives and Blasting Supplies

The W. S. Tyler Co.
3615 Superior Ave., N. E., Cleveland, Ohio
Wire Screens, Screening Machinery, Scrubbers, Testing Sieves and Dryers

Warren Brothers Roads Co.
P. O. Box 1869, Boston, Mass.
or
38 Memorial Drive, Cambridge, Mass.
Complete plants and separate plant units for bituminizing all types of stone, sand and gravel aggregate paving mixtures

Westinghouse Electric and Mfg. Co.
East Pittsburgh, Pa.

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